air conditioning. In addition to ensuring that the subsystem performs as desired, the control system operates the associated equipment as efficiently as possible.

[0003] A large entity may have numerous buildings under common management, such as on a university campus or a chain of stores located in different cities. To accomplish this, the controllers in each building gather data regarding performance of the building subsystems, which data can be analyzed at the central monitoring location.

[0004] With the cost of energy increasing, building owners are looking for ways to conserve utility consumption. In addition, the cost of electricity for large consumers may be based on the peak use during a billing period. Thus high consumption of electricity during a single day can affect the rate at which the service is billed during an entire month. In addition, certain preferential rate plans require a customer to reduce consumption upon the request of the utility company, such as on days of large service demand throughout the entire utility distribution system. Failure to comply with the request usually results in stiff monetary penalties, which raises the energy cost significantly above that for an unrestricted rate plan. Therefore, a consumer has to analyze the energy usage in order to determine the best rate plan and implement processes to ensure that operation of the facility does not inappropriately cause an increase in utility costs.

Please replace paragraphs **[0006]-[0009]** on pages 3-4 with the following:

[0006] As a consequence, sensors are being incorporated into building management systems to measure utility usage for the entire building, as well as specific subsystems such as heating, air conditioning and ventilation equipment. These management systems collect and store massive quantities of utility use data, which is overwhelming to the facility operator when attempting to analyze that data in an effort to detect anomalies.

[0007] Alarm and warning systems and data visualization programs often are provided to assist in deriving meaningful information from the gathered data. However, human operators must select the thresholds for alarms and warnings, which is a daunting task. If the thresholds are too tight, then numerous false alarms are issued; and if the thresholds are too loose, equipment or system failures can go undetected. The data visualization programs can help building operators detect and diagnose problems, but a large amount of time can be spent detecting problems.

Also, the expertise of building operators varies greatly. New or inexperienced operators may have difficulty detecting faults, and the performance of an operator may vary with the time of day or day of the week.

[0008] Therefore, there is a need for robust data analysis methods to automatically determine if the current energy use is significantly different than previous energy patterns and, if so, to alert the building operator or mechanics to investigate and correct the problem.

[0009] Abnormal utility usage by a building or a particular apparatus in the building can be determined by repeatedly measuring the level of use of the utility, thereby producing a plurality of utility measurements. A Generalized Extreme Studentized Deviate (GESD) statistical procedure is applied to the plurality of utility measurements to identify any measurement outliers. The measurement outliers denote times when unusual utility consumption occurred, thereby indicating times during which operation of the building or the particular apparatus should be investigated.

Please replace paragraph **[0016]** on pages 5-6 with the following:

[0016] Periodically the building management system 16 gathers data from the sensors and stores that information in a database contained within the memory of the computer for the building management system. The frequency at which the data is gathered is determined by the operator of the building based on the type of the data and the associated building function. The utility consumption for functions with relatively steady state operation can be sampled less frequently, as compared to equipment with large variations in utility consumption.

Please replace paragraph **[0020]** on pages 7-8 with the following:

[0020] Figure 3 depicts the peak daily consumption for this building over a period of four weeks. The weekday peaks are significantly greater than the peak consumption on the weekends. Point 30 represents a day when peak consumption of electricity was abnormally high. This may have been caused by a large piece of equipment turning on unexpectedly, for example an additional chiller of an air conditioning system activating on a single very hot day. The data value for this abnormally high level is referred to as an "outlier" and building operators are

interested in finding such outliers and learning their cause. Outliers often result from equipment or system control malfunctions which require correction.

Please replace paragraphs **[0023]-[0024]** on pages 8-9 with the following:

[0023] Prior to the analysis, the user needs to specify the probability of incorrectly declaring one or more outliers when no outliers exist and an upper bound (n_u) on the number of potential outliers. The probability defines the sensitivity of the process and is redefined periodically based on the number of false warnings that are produced by the system finding outliers. In other words, the probability is adjusted so that the number of outliers found results in an acceptable level of warnings of abnormal utility consumption within the given reporting period, recognizing that false warnings cannot be eliminated entirely and still have an effective evaluation technique. The upper bound (n_u) specifies a maximum number of data samples in set X that can be considered to be outliers. This number must be less than fifty percent of the total number of data samples, since by definition a majority of the data samples cannot be outliers, i.e., $n_u \le 0.5(n\text{-l})$. For example, an upper bound (n_u) of thirty percent can be employed for electricity consumption analysis.

[0024] The data analysis commences at step 40 by setting the initial value n_{out} for number of outliers to zero. Then at step 42, a FOR loop is defined in which the program execution loops through steps 44-58 processing each data sample specified by the upper bound n_u, i.e. samples x_i, where i = 1,2,3,..., n_u. The arithmetic mean ($\bar{x}$) of all the elements in set X is calculated at the first step 44 of this loop. Then at step 46, the standard deviation (s) of the elements in set X is calculated.

Please replace paragraphs **[0029]-[0030]** on page 12 with the following:

[0029] At step 58, the extreme elements $x_{e,i}$ is removed from set X and the number of elements in that set now equals *n-i*. The algorithm then returns to step 42 to repeat the process and hunt for another outlier. Eventually the set of data samples becomes reduced to the upper bound (n_u) at which point the FOR loop terminates by branching to step 60. At that point, the outliers have been identified with a set of outliers given by $X_{out} \in \{x_{e,1}, x_{e,2}, \ldots, x_{e,n_{out}}\}$. If no outliers were found in set X, then X_{out} is an empty set.